DETAILED ACTION

Specification

The following guidelines illustrate the preferred layout for the specification of a utility application. These guidelines are suggested for the applicant's use.

Arrangement of the Specification

As provided in 37 CFR 1.77(b), the specification of a utility application should include the following sections in order. Each of the lettered items should appear in upper case, without underlining or bold type, as a section heading. If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

(a) TITLE OF THE INVENTION.
(b) CROSS-REFERENCE TO RELATED APPLICATIONS.
(c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.
(d) THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT.
(e) INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC.
(f) BACKGROUND OF THE INVENTION.
    (1) Field of the Invention.
    (2) Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98.
(g) BRIEF SUMMARY OF THE INVENTION.
(h) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S).
(i) DETAILED DESCRIPTION OF THE INVENTION.
(j) CLAIM OR CLAIMS (commencing on a separate sheet).
(k) ABSTRACT OF THE DISCLOSURE (commencing on a separate sheet).
(l) SEQUENCE LISTING (See MPEP § 2424 and 37 CFR 1.821-1.825. A "Sequence Listing" is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required "Sequence Listing" is not submitted as an electronic document on compact disc).

The disclosure is objected to because of the following informalities:

1. The Specification does not include section headings as outlined above; and

2. The Specification does not include a section for the cross-reference to the related applications.

Appropriate correction is required.

Claim Objections

Claims 1, 8, and 14 are objected to because of the following informalities: the claims do not separate claim elements by line indentation for clarity. Where a claim sets forth a plurality of elements or steps, each element or step of the claim should be separated by a line indentation. 37 CFR 1.75(i), MPEP 608.01(m). Appropriate correction is required.

Claim 14 is objected to because of the following informalities: the preamble of the claim describes a method of treating a metallic component “such as” a rotor or stator. While this is considered a recitation of intended use, the term “such as" does not distinctly define the intended use as it is an open-ended description without definitive meets and bounds. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 9-10 and 19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 9 recites the limitation “said coating” in line 1. As claim 8 upon which it depends refers to several coatings, it is not clear as to which coating claim 9 is referencing. Therefore the claim is indefinite. For purposes of examination, “said coating” is interpreted as referring to the ceramic coating as this appears to be in conformance with the claims as originally filed and the specification.

Claim 10 recites the limitation “said coating” in line 1. As claim 8 upon which it depends refers to several coatings, it is not clear as to which coating claim 9 is referencing. Therefore the claim is indefinite. For purposes of examination, “said coating” is interpreted as referring to the ceramic coating as this appears to be in conformance with the claims as originally filed and the specification.

Claim 19 recites the limitation "the aluminum-containing metallic oxidation protection coating" in lines 1-2. There is insufficient antecedent basis for this limitation in the claim.

Further, claim 19 refers to an oxidation protection coating comprising NiCoCrAlY wherein there is already a NiCoCrAlY coating in claim 14 upon which it depends. It is unclear as to whether the NiCoCrAlY coating of claim 19 is the same as that referred to in claim 14. As the specification does not appear to discuss multiple layers of NiCoCrAlY, the subject matter of claim 19 appears to be an inadvertent error. As it is impossible to determine whether this is the case or if the intent was to claim multiple NiCoCrAlY layers, the claim is indefinite for failing to particularly point out and distinctly claim the subject matter of the invention. As the scope of the claim is indeterminable, it will not be treated further in this Office Action.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 5-12, 14, and 17-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Qadri et al. (US 5,800,934).

Qadri et al. teach a method of using stabilized zirconia (ZrO_2) in forming thermal barrier coatings for turbine engine hot-end components. The method includes application of an outer stabilized zirconia ceramic coating to a MCrAlY bond coat directly disposed over a metallic superalloy substrate (column 3, lines 12-21). The MCrAlY bond coat is expected to provide some level of oxidation protection as like materials are used in a like manner to the claims. The thickness of the ceramic coating may be 10 to 100 microns (column 3, lines 50-53). As the ceramic coating is the last coating applied to the component, the coating is considered to be an exposed outer layer as claimed.

Regarding claims 1-2, 5, 7-8, and 14, the thickness of the ceramic coating may be 10 to 100 microns (column 3, lines 50-53).

Regarding claim 6, the ceramic coating material may consist of stabilized zirconia which is an oxidic ceramic material (column 3, lines 12-21).

Regarding claims 9-10, the ceramic coatings may be produced by EB-PVD or other deposition processes such as plasma spray (of which CVD is an example) (column 2, lines 58-65).

Regarding claims 11-12, the turbine component may be a turbine blade, of which rotor and stator blades are examples (column 1, line 10).

Regarding claims 17-18, the MCrAlY bond coat has a composition where M is cobalt, nickel, or iron including combinations thereof (column 3, lines 12-21, claim 4).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-2, 5-12, 14, and 17-18 are rejected under 35 U.S.C. 103(a) as obvious over Rigney et al. (US 6,455,167) in view of Qadri et al. (US 5,800,934), Strangman et al. (US 5,015,502), and Ulion et al. (US 5,262,245).

Rigney et al. teach a turbine airfoil under thermal and mechanical stress with a protective coating to combat oxidation, corrosive attack, and undesirable interactions between the substrate and bond coat (column 5, lines 41-48). The protective coating is made by applying to a metallic component 32 a thin diffusion barrier layer 33 comprised of oxidic ceramic material, a bond coat 34, and an outer ceramic topcoat 36 in sequence (Figs. 4 and 6). The bond coat has a high concentration of aluminum, such

as MCrAlX coatings where M may be combinations of Ni, Fe, and Co, and will provide oxidation protection as like materials are used in a like manner to the claims (column 4, lines 28-33; column 5, lines 16-24). The exposed outer ceramic topcoat may be formed of YSZ, yttria stabilized ZrO_2 (column 5, line 22). Thus the exposed ceramic topcoat 36 (considered the claimed ceramic coating) is applied directly to the bond coat 34 (considered the claimed oxidation protection coating) which overlies the metallic component 32 and meets the limitations of the claims.

In the alternative, Rigney et al. teach it is known in the prior art to have a superalloy substrate overlaid with an aluminum-based bond coat over which an exposed YSZ topcoat is applied directly (Fig. 2; column 4, lines 38-49). Thus the exposed YSZ topcoat 16 (considered the claimed ceramic coating) is applied directly to the bond coat 14 (considered the claimed oxidation protection coating) which overlies the metallic component 12 and meets the limitations of the claims.

Regarding claims 1-2, 5, 7-8, and 14, Rigney et al. do not teach the thickness of the outer ceramic topcoat.

Qadri et al. teach a method of using stabilized zirconia (ZrO_2) in forming thermal barrier coatings for turbine engine hot-end components as described above. The ceramic for formation of the ceramic coating is zirconia which has the chemical structure ZrO_2 (column 3, lines 12-21). The thickness of the ceramic coating may be 10 to 100 microns (column 3, lines 50-53). Therefore, as Qadri et al. clearly teach an appropriate thickness for an outer zirconia coating on a turbine engine component is 10-100 microns, it would have been obvious to one of ordinary skill in the art at the time of the

claimed invention to form the outer ceramic topcoat for coating a turbine component of Rigney et al. with a thickness of 10-100 microns. Furthermore, it would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the thickness of the outer coating for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). In the present case, the thickness of the coating is a result effective variable as it determines the amount of protection and additional cost of the component. It would be obvious to one of ordinary skill in the art to discover an optimum value for the thickness that provides sufficient protection at an appropriate cost and arrive at a thickness overlapping the claimed range.

Strangman et al. teach a turbine engine component coated with a ceramic coating as described above. The ceramic for formation of the ceramic coating is zirconia which has the chemical structure ZrO_2 (column 5, line 17). The thickness of the ceramic coating may be 1 to 1000 microns (column 6, lines 1-5). Therefore, as Strangman et al. clearly teach an appropriate thickness for an outer zirconia coating on a turbine engine component is 1-1000 microns, it would have been obvious to one of ordinary skill in the art at the time of the claimed invention to form the outer ceramic topcoat for coating a turbine component of Rigney et al. with a thickness of 1-1000 microns. Furthermore, it would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the thickness of the outer coating for the intended application, since it has been held that discovering an optimum value of a result

effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). In the present case, the thickness of the coating is a result effective variable as it determines the amount of protection and additional cost of the component. It would be obvious to one of ordinary skill in the art to discover an optimum value for the thickness that provides sufficient protection at an appropriate cost and arrive at a thickness overlapping the claimed range.

Likewise, Ulion et al. teach a turbine engine component coated with a ceramic as described above. The most preferred ceramic for formation of the ceramic coating is zirconia which has the chemical structure ZrO_2 (column 2, lines 38-41). The thickness of the ceramic coating may be 25 to 500 microns (e.g., claim 2 and column 6, lines 14-18). Therefore, as Ulion et al. clearly teach an appropriate thickness for an outer zirconia coating on a turbine engine component is 25-500 microns, it would have been obvious to one of ordinary skill in the art at the time of the claimed invention to form the outer ceramic topcoat for coating a turbine component of Rigney et al. with a thickness of 25-500 microns. Furthermore, it would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the thickness of the outer coating for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). In the present case, the thickness of the coating is a result effective variable as it determines the amount of protection and additional cost of the component. It would be obvious to one of ordinary skill in the art to discover an

optimum value for the thickness that provides sufficient protection at an appropriate cost and arrive at a thickness overlapping the claimed range.

Regarding claim 6, the ceramic topcoat material may consist of an oxidic ceramic material (column 5, line 22).

Regarding claim 9, the ceramic coating may be produced by EB-PVD (column 7, line 41).

Regarding claim 10, the ceramic coating may be produced by CVD (column 7, line 40).

Regarding claims 11-12, Rigney et al. teach a coating for a turbine airfoil as described above. Rigney et al. do not specifically teach the airfoil is part of a rotor or stator. However, airfoils are generally parts of rotor and stator turbine components (e.g., rotor and stator blades). In the alternative, it would be obvious to apply the coating to other rotor and stator components to one of ordinary skill in the art to obtain the benefits of resistance to turbine environmental stresses. Further, forming airfoils and other components of rotors and stators of the same materials and coatings negates changes in thermal expansion that could otherwise cause failure when subjected to the high heats of the turbine environment. Thus one of ordinary skill in the art is provided motivation to coat rotor and/or stator components, including airfoils, with the same coating to reduce the risk of failure due to differences in rates of thermal expansion.

Regarding claims 17-18, the MCrAlY bond coat has a composition where M is cobalt, nickel, or iron including combinations thereof (column 4, lines 28-33).

Response to Arguments

Applicant's arguments, see the Remarks, filed 11/24/09, with respect to the previous rejection of claim 13 under 35 USC 112, first paragraph, the rejections over Strangman et al. (US 5,015,502) alone under 35 USC 102, and the rejections over Ulion et al. (US 5,262,245) alone under 35 USC 102 and as a primary reference under 35 USC 103 have been fully considered and are persuasive in light of the present amendments. These rejections and objections have been withdrawn.

Applicant's arguments filed with respect to the rejections over Rigney et al. as a primary reference under 35 USC 103 have been fully considered but they are not persuasive.

Applicant primarily argues Rigney et al. do not teach the claimed thickness of the outer ceramic coating and the addition of the teachings of Strangman and Ulion does not make the claimed thickness obvious. More particularly, Applicant argues the coatings of the cited references are used in thermal barrier applications rather than to prevent rumpling/wrinkling and thus do not anticipate or make obvious the unexpected results obtained using the narrower thicknesses claimed.

In response, in addressing allegations of unexpected results the issue is whether the properties differ to such an extent that the difference is really unexpected. *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986), MPEP 716.02. In the present case, Applicant acknowledges "thick ceramic layers prevent thermally influenced wrinkling" but fails to provide 1) reasons as to why this phenomenon would

not be experienced with thinner layers, or 2) an identification of what thicknesses would not be expected to reduce wrinkling to some degree (the Reply at page 15, lines 16-17). The burden is on Applicant to establish "that the differences in results are in fact unexpected and unobvious and of both statistical and practical significance." Ex parte Gelles, 22 USPQ2d 1318, 1319 (Bd. Pat. App. & Inter. 1992); MPEP 716.02(b). The evidence pointed to in the present specification suggests thin coatings may be more desirable than thicker coatings for some applications but it does not appear to establish why one would find suppression of wrinkling at the claimed thicknesses to be unexpected. More particularly, the arguments fail to support the conjecture that reduction in wrinkling is unexpected at the claimed ranges. In fact, as any layer overlying another would be expected to reduce wrinkling to some extent due to downward pressure from the overlying layer impeding movement of the under layer, the physics of the interaction between the layers would suggest that some reduction in wrinkling is in fact expected rather than unexpected.

Applicant further argues Strangman and Ulion vary the thickness in response to need for thermal resistance whereas the present claims are directed to a coating that provides substantially no heat-insulation. The argument states that if anything the optimization of the thickness of the coatings in view of Strangman and Ulion suggest greater thickness for providing increased thermal barrier protection and protection from spalling. In response, this argument ignores the portions of the ranges identified in the prior art which directly overlap the claimed ranges. Contrary to the argument presented, there is nothing in the references cited to suggest only the larger thicknesses over the

disclosed ranges are desired. The ranges are disclosed for the suitability of any value within the ranges for use as a thermal barrier ceramic coating, including those values overlapping the claimed ranges. More particularly, in providing the ranges the references are suggesting it is known in the art to use both thicker and thinner coatings depending on the application. The suggestion that the references only provide for reason to use the upper ends of the ranges disclosed is not commensurate with the teachings of the prior art.

Further, the claimed ranges for thickness of the ceramic coating are entirely overlapped by the ranges for thickness taught by the references. Moreover, the reference to Qadri et al. has been added to show a much narrower range that still overlaps the claimed ranges in addition to examples wherein thicknesses at the lower end of the range are desirable. Clearly the ranges are taught by each of the references to provide workable values for thickness depending on the application rather than to suggest only the upper end of the ranges are desirable as Applicant suggests. Thus the suggested thicknesses for the thermal barrier ceramic coatings include the claimed values and as such the properties of the coatings at those thicknesses are expected to be as claimed as like materials are used in a like manner. Mere recognition of latent properties in the prior art does not render nonobvious an otherwise known invention. *In re Wiseman*, 596 F.2d 1019, 201 USPQ 658 (CCPA 1979); MPEP 2145(II).

Finally, Applicant argues it could not have been predicted by a person of ordinary skill in the art that the presently claimed thin layer could prevent wrinkling/rumpling. However, as noted above, as any layer overlying another would be expected to reduce

wrinkling to some extent due to downward pressure from the overlying layer impeding movement of the under layer, the physics of the interaction between the layers would suggest that some reduction in wrinkling is in fact predictable. Further, as also noted above, the prior art establishes formation of ceramic thermal barrier topcoats with thicknesses in the ranges claimed is known in the art. While the references may not discuss wrinkling/rumpling suppression, the use of the same materials as claimed in the same manner as claimed is expected to produce a reduction in wrinkling/rumpling in the same manner taught by Applicant. There is nothing in the art or evidence submitted by Applicant to suggest the reduction in wrinkling/rumpling is not a latent property of the coatings disclosed by the prior art.

For these reasons Applicant's arguments are unconvincing.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AARON S. AUSTIN whose telephone number is (571)272-8935. The examiner can normally be reached on Monday-Friday: 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on (571) 272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Aaron S Austin/
Examiner, Art Unit 1794